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AND THE BEST METHOD OF ACCOM-
PLISHING THAT RESULT

The Seaman Prize Essay

By MAJOR JEFFERSON RANDOLPH KEAN,
SURGEON IN THE UNITED STATES ARMY.



Reprint from the
Journal of the Association of Military Surgeons
of the United States.

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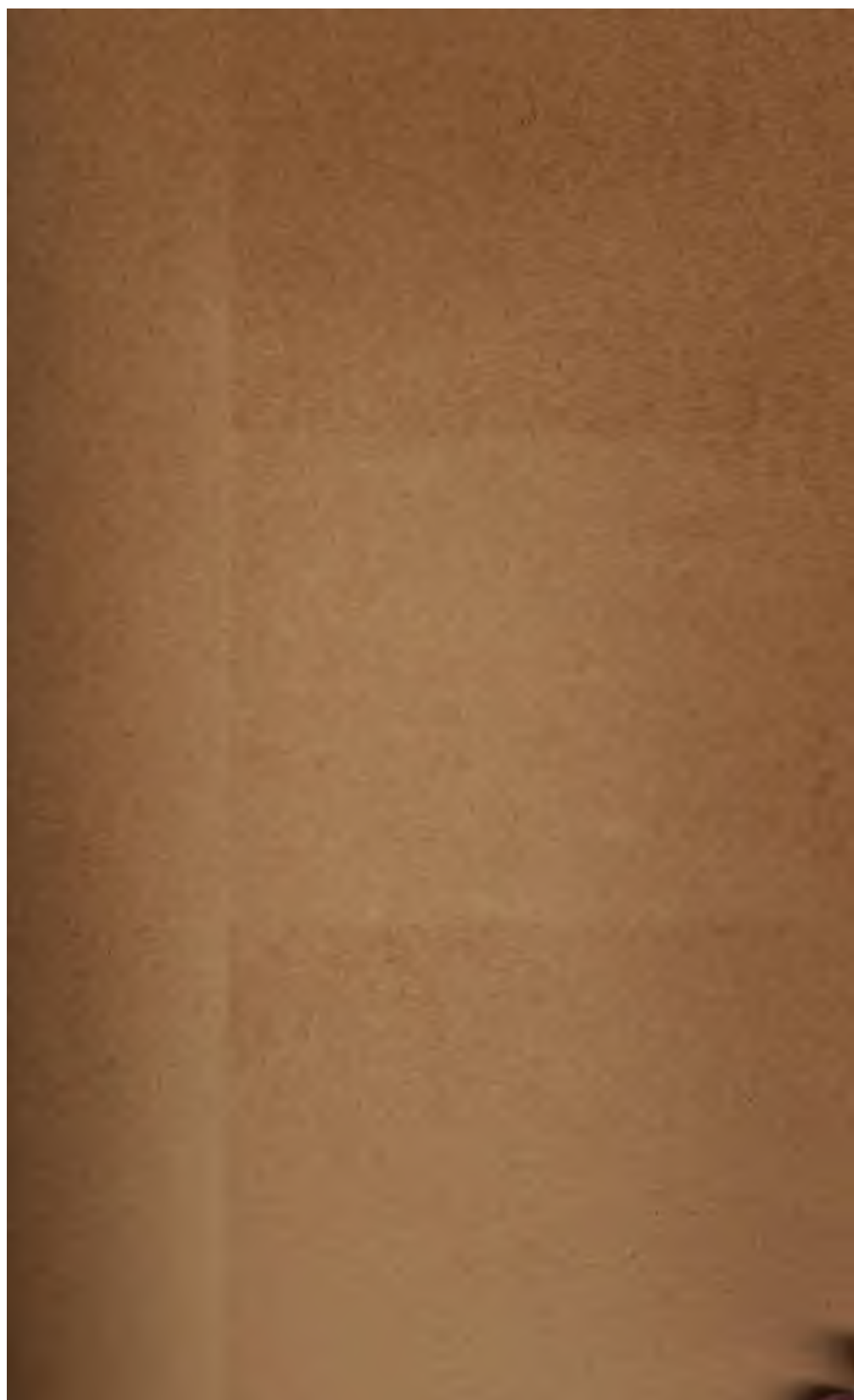
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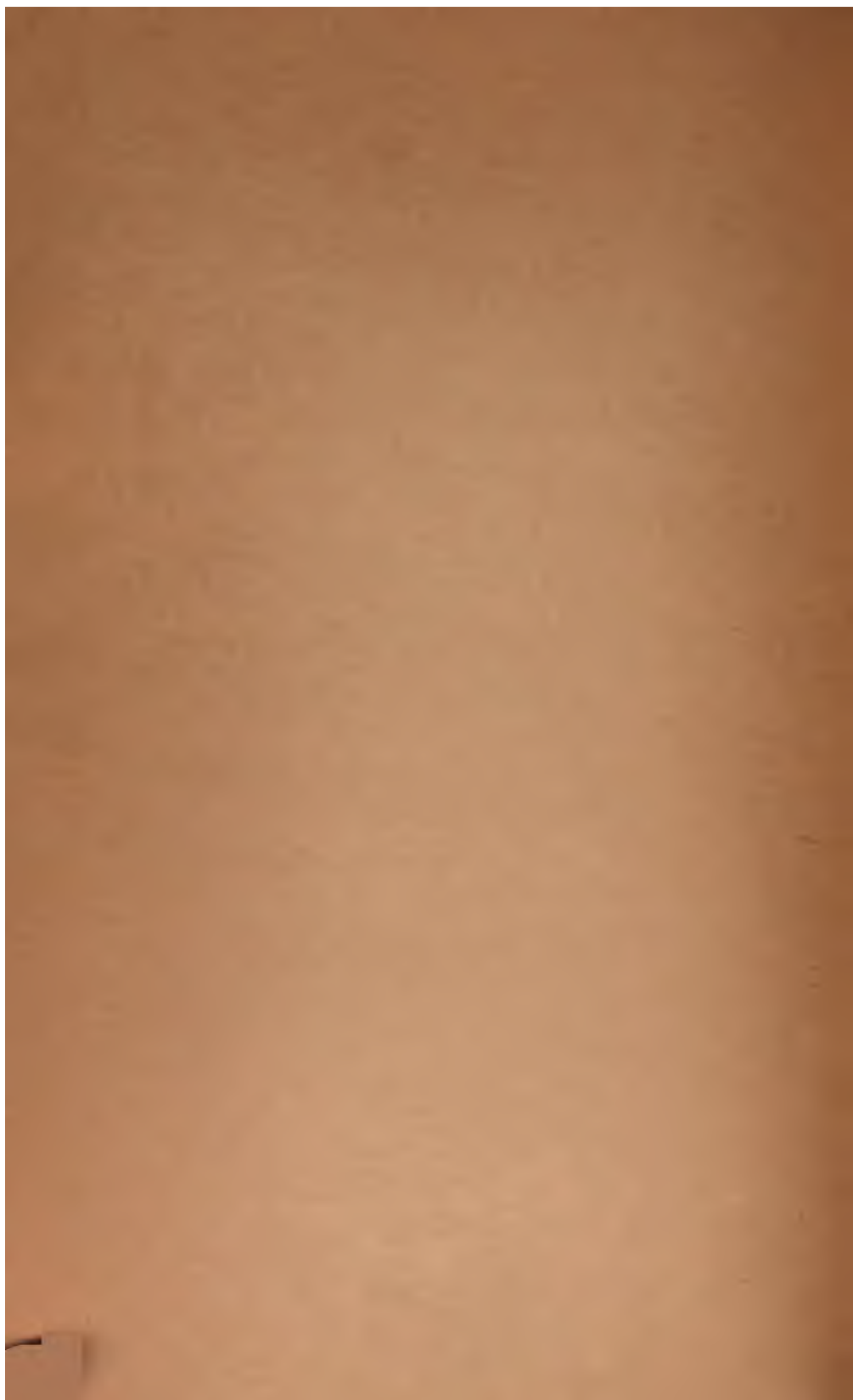
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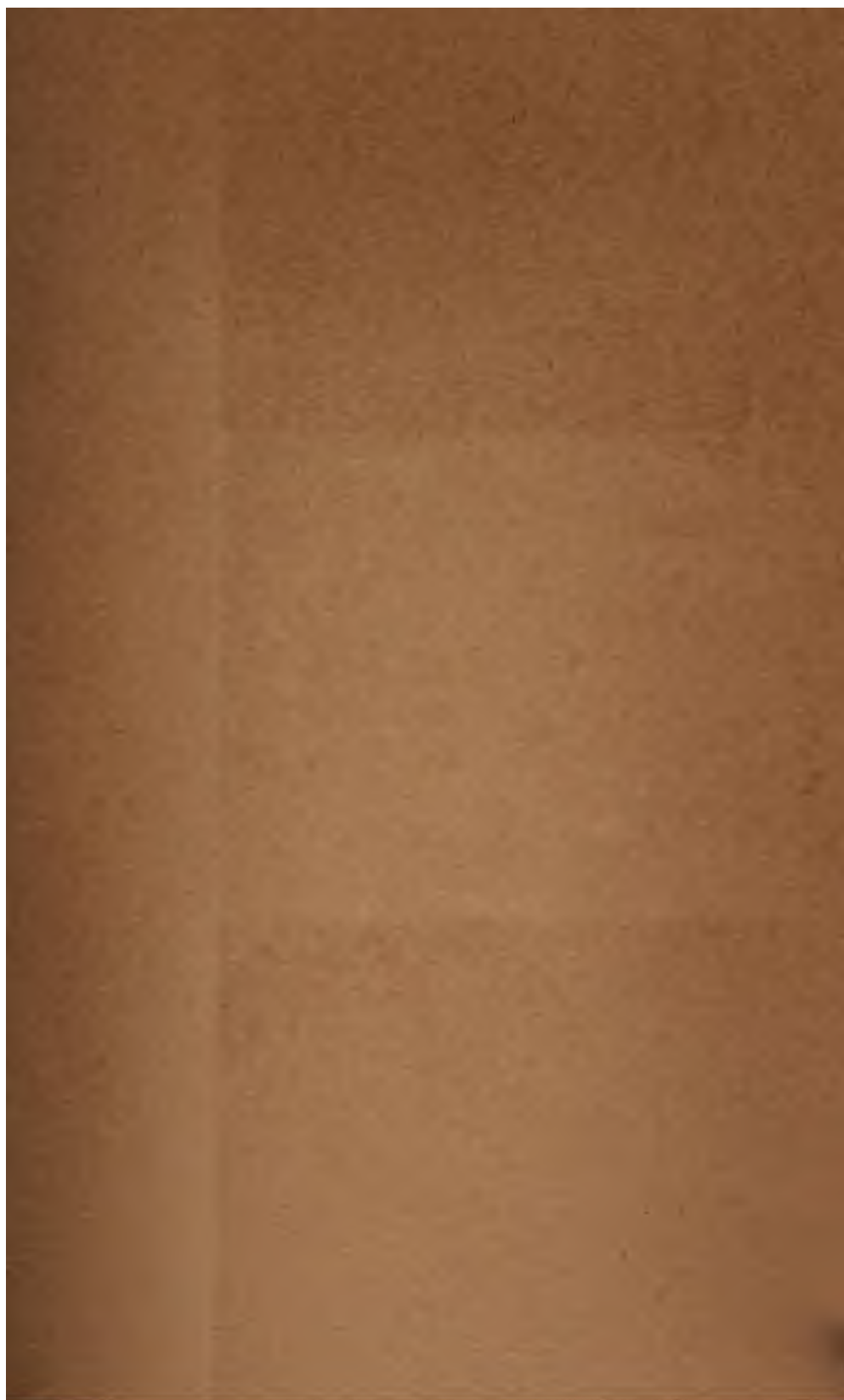


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The Seaman Prize Essay.

THE PREVENTION OF DISEASE IN THE ARMY AND
THE BEST METHOD OF ACCOMPLISHING
THAT RESULT.

By MAJOR JEFFERSON RANDOLPH KEAN,
SURGEON IN THE UNITED STATES ARMY.



It has been said that an Army is the most complex machine which has been devised by the mind of man. This is the more true now when every science is made ancillary to the art of destruction and modern specialism has invaded every department of the military profession. Military

medicine is now feeling the full force of this progressive tendency, influenced as it is likewise by the kaleidoscopic changes which have marked medical progress in the last quarter of a century. The direction of this progress has been to add to the duty of caring for the sick and wounded, which was formerly almost the only responsibility of the Medical Staff, the supervision of the hygiene of the troops and the prevention of disease among them. In this way the Medical Department has been able not only to comply with the altruistic de-

mands of the age, but to directly and powerfully contribute to the military efficiency of armies. There has also been a great advance in the way of more perfect organization and better and more specialized training for the medical personnel, as well as improvement in equipment, so that the comfort of patients has been much promoted.

Preventive medicine in its broader sense and apart from the personal and domestic point of view is a specialty with which the ordinary medical practitioner has little to do and of which he has but little knowledge either theoretical or practical. Its knowledge and practice is thus confined to a relatively small number of health officers, military surgeons (including naval surgeons), and professional epidemiologists. But because of the special conditions and exceptional environment of military life, notably in the case of armies in the field, and because there the preservation of health cannot be considered as in civil life the cardinal consideration, but must often be subordinated to the imperious demands of military necessity, we find that for the soldier many of the rules of preventive medicine either cannot be applied or must be greatly modified. So military hygiene has arisen as a further specialized offshoot of preventive medicine, and one so far removed from the well beaten paths of medical practice that civil practitioners cannot be expected to acquire proficiency in it by the mere act of accepting a commission.

The first step in the study of the prevention of disease in the Army is to ascertain what diseases most seriously affect its efficiency or cause the chief loss to the effective force. When ascertained they are divisible into the preventable and non-preventable, and for the former the approved methods of prevention, which apply to individual diseases or classes of diseases, as well as those which are of general application, will be discussed. This will, however, not complete the subject, for unfortunately it is a fact that it is no more possible for an army to be made healthy by military order than for people to be made virtuous by Act of Congress. If the sanitary rules laid down in Circular No. 1, of the Surgeon General's Office, April 25, 1898, and G. O. 117, A. G. O., of August 10, of that year, had been carefully

followed throughout the Army, the camps would have been health resorts, and the country would have been saved the melancholy lesson of more than 20,000 cases of typhoid fever in the Army in 1898, with more than 2,000 deaths. But with an untrained Army of volunteers, and a Medical Department in which the vast majority of officers and men were equally untrained, these carefully framed sanitary regulations fell nearly as far short of their purpose as did G. O. 87 of that year, enjoining abstinence from alcoholic drinks, in producing a blue-ribbon Army. No method of disease prevention can, therefore, be efficacious which does not embrace the necessary executive machinery to procure its practical working, and so some discussion of what is needed to secure an efficient Medical Department and the cordial co-operation of the line in questions of sanitation is as essential to our purpose as are the horses to a stage coach or an engine to a train.

Having thus outlined the scope of our inquiry it is in order to take up the subject of the occurrence of disease in armies.

The influence of modern civilization upon the health of mankind is, except for the submerged tenth, conservative. Men are abundantly and regularly fed and well clothed, and are protected by warm houses from the exposures of winter. Municipal government provides an abundance of water which is usually pure, and for the prompt removal of wastes and filth. The law enforces sanitary rules and compels the segregation of many contagious diseases. The sick are cared for in hospitals and in many ways the physically unfit are protected from the operation of the great natural law which provides for their extinction. By the force of custom, comforts and luxuries come to be regarded as necessities and men's wants are greatly multiplied. When however, the citizen becomes a soldier, he finds that this tendency is promptly and rudely reversed and that the wants, luxuries, and habits of a lifetime are stripped off by the rough hand of military necessity until he stands forth the fighting man of all the centuries, divested of everything except the weapon in his hand and the clothes on his back, cooking his simple evening meal before the fire, with the earth for his bed and the sky for his roof. In.

stead of abundant, well-cooked and regular meals, he eats his beans, bacon and bread at more or less irregular hours. Instead of a warm house and comfortable bed, he must learn to march all day in rain-soaked clothes and sleep on wet or frozen ground. He has to drink such water as he can get, and will not always be able to boil it. He will be not always able to protect himself from the filth of others, and will soon find that a perfect method of disposal of wastes in camp is yet to be discovered. During this period of reversal to primitive conditions it is not surprising that sickness results. The effects of an unaccustomed and usually ill-prepared diet are seen in attacks of bowel disturbance, to which are often added specific infections, such as dysentery, making up a disease group the several members of which, although not having the same aetiological factors in all cases, clinically are merged together and are considered together in military statistical reports. In those of the Civil War, this group far exceeds any other as a cause of admissions, and likewise deaths and discharges (See Tables IV and VI). Until the soldier becomes hardened to exposure, rheumatism, bronchitis, and colds contribute heavily to the sick report, but as he becomes a veteran, the rate steadily falls, being largely contributed by the recruits.

MEDICAL STATISTICS OF ARMIES.

The diseases of armies in time of peace differ markedly from those of wartime, not only in their degree of prevalence, but in their comparative importance, and while the prevention of disease of armies in wartime is the cardinal object of our study, an examination of the peace morbidity of a few of the principal armies makes an instructive basis of comparison. It is the more valuable because from the international military statistical tables can be ascertained the constant non-effective rate from each of the more important diseases, and thus we are given a better basis for estimating their effect on the efficiency of armies than is afforded by either admissions or total losses.

The following table shows the constant non-effective rate per thousand for the eight most important classes of diseases in the

armies of England, France, and Germany, as compared with our own:

TABLE I.	U. S. 1903.	England 1902.	France 1901.	Germany 1902.
Venereal diseases.....	9.63	12.09	2.38	1.88
Dysentery	4.61	.75	.28	.01
Skin diseases.....	3.00	2.07	1.13	.59
Malarial diseases.....	2.88	3.12	.64	.02
Tuberculosis.....	1.87	.52	.59	.34
Respiratory diseases*.....	1.44	1.59	3.01	2.65
Typhoid fever.....	1.02	1.61	.81	.14
Articular rheumatism.....	.51	1.53	1.02	.93

The most striking feature of this table is the predominance of venereal diseases in England and America, as compared with the Continental countries. This is due, as is well known, not to any greater laxity of morals in the former nations, but to a peculiar intolerance in the moral sentiment of the public in the English race, which will not permit the same safeguards to be taken to prevent the spread of those affections, which are used in the case of other contagious diseases. This question will be touched on later in discussing the prophylaxis of these diseases.

Dysentery, malaria, and skin diseases are higher in the English and American Armies because of their larger proportion of troops in the tropics, and respiratory diseases are less for the same reason; the tabulated reports showing much larger admissions for the former, and smaller for the latter, in the tropics than at home stations.

The large figure for tuberculosis in the United States represents rather a different method of disposal than any special prevalence of the disease. In the other services consumptives are promptly discharged and sent home; while in the United States they are transferred to a sanitarium for treatment. While the Army benefits by the former method of disposal, the health of the civil population suffers from the distribution of a contagious disease among its homes. This disease does not seriously affect the military efficiency of armies in the field, the open air life

*Includes pneumonia, pleuritis and bronchitis.

being unfavorable to its spread and exercising a curative influence, in many cases, over those slightly infected.

Typhoid fever occupies an obscure and humble position in the statistical tables of peace times as compared with its predominating and sinister importance in war. Its figure is still too high in our Army, as may be seen by comparison with the German Army.

The absence of diseases of the digestive tract, other than dysentery, must be noticed, as under war conditions these hasten to assert themselves. Of these, all must be considered as preventable except rheumatism and the respiratory diseases, and for the latter, their occurrence in barracks can be much restricted by providing sufficient ventilation and air-space.

DISEASES OF ARMIES IN WAR.

THE RUSSO-JAPANESE WAR.

Of the medical statistics of the great war now raging in Manchuria we know but little. In no recent war have military secrets been so carefully guarded as by the Japanese in this, so that it has been impossible to learn, where data relating to morbidity have been given out, what is the mean strength of the forces concerned, or even that of the medical units. Enough has, however, been learned to greatly stimulate our curiosity, and to emphasize the importance to armies of careful preparation for war in the medical department as in the ordnance or artillery, and the necessity of an adequate and well instructed medical personnel.

The First Army (Kuroki's) with a mean strength of 57,000 to 60,000 men, and an unknown number along the lines of communication, had in the four months between the battles of the Yalu and Liaoyan, 28,278 admissions from the fighting force, and 34,935 from the lines of communication; of these, 861 were dysentery, 101 typhoid, and 4,069 kakke or beri-beri.

The second Army (Oku's) in the seven months from May 1st to December 1st, 1904, had from the active army 24,642 admissions, of which 342 were dysentery, 193 typhoid, and 5,070 kakke. 5,609 cases were sent back to Japan and 40 deaths are reported at the front. The number of deaths in stationary and base hospitals has not been reported, but as 18,578 cases are re-

ported as having recovered in the field, the number of deaths along the lines of communication is probably covered by the 415 cases unaccounted for. The strength of this army was also three divisions, approximately 57,000 men. The remarkably small number of cases of both typhoid fever and dysentery, with the compensating prevalence of beri-beri, are interesting points to us, for whom the former two have been always the scourge of our armies in the field. The reasons for the freedom of the Japanese from them will be discussed later.

In the war between China and Japan in 1894-5, although the morbid statistics have not been published in full, it is known that the Japanese Army suffered severely from preventable diseases.

There were 9,658 cases of cholera, with 5,991 deaths and 13,009 of dysentery, with 1,662 deaths. The total number of deaths was 15,860 out of 227,600 men brought into the field, being a total death rate of 69 per 1,000. This army is reported to have suffered severely from beri-beri also.

THE SPANISH-AMERICAN WAR—1898.

For an accurate and scientific medical history of this war, the Santiago Expedition, the Philippine Expedition, and the Volunteer forces in the United States should be treated separately, but a companion history to the great Medical and Surgical History of the War of the Rebellion has not yet been written for it. In general terms it may be said that for the volunteer camps of the United States, typhoid fever was the principal disease; for the Philippine Expedition, malaria and diarrhoeal diseases; while malaria and yellow fever were the chief morbid factors which in six weeks reduced the gallant and well-disciplined little army under General Shafter to absolute impotence. For the whole war the admissions and total loss (*i. e.* deaths and discharges) per thousand of mean strength were as follows:

TABLE II.		
	Admissions per 1,000.	Total loss per 1,000.
Malarial diseases,	612	2.36 (2)
Diarrhoeal diseases,	389	1.89 (3)
Typhoid fever,	142	15. (1)
Respiratory diseases,	137	1.59 (4)
Venereal diseases,	82	1.09 (5)

The figures in brackets after the total loss give the comparative standing as to total loss of the several diseases.

TABLE III.
PHILIPPINE INSURRECTION AND PEKIN EXPEDITION, 1900.

	Admissions per 1,000.	Total loss per 1,000.
Malarial diseases,	847	2.1 (2)
Diarrhoeal diseases,	561	10. (1)
Venereal diseases,	128	1.14 (4)
Respiratory diseases,	62	1.08 (5)
Typhoid fever,	11	1.95 (3)

The high death rate from diarrhoeal diseases is due to dysentery. It will be observed that typhoid fever has sunk to a very subordinate position as compared with the Spanish War, but that malaria has held its own.

BOER WAR.

The morbid statistics of this war have not yet been published in full. The war lasted two years, during which time out of a total force sent to South Africa of 448,000 men, 12,911 died of disease. Of these, 6,177 died of typhoid and 973 of dysentery.

The prevalent causes of admission were, in order of importance:

Typhoid,
Diarrhoeal diseases,
Rheumatism, chiefly muscular,
Malaria.

It is probable that their order arranged according to total loss would be the same.

As a case mortality for typhoid of nineteen per cent is reported, it is probable that, as in our Spanish War, many of the milder cases were not recognized as typhoid and appear under other names, such as malaria and simple continued fever.

In the Franco-Prussian War the Germans lost in killed, 17,255, and from disease, 14,904, in the active army; the total admissions to hospital for the first twelve months being 589 per thousand of mean strength. Typhoid fever caused sixty per cent and dysentery sixteen per cent of all deaths from disease.

CIVIL WAR, 1861-65.

On account of the very complete records of the United States Army during this war, and the masterful way in which these records have been collated and discussed in the Medical and Surg-

ical History of the Rebellion, this history will always remain an inexhaustable mine of information to the students of military medicine. The ratios per thousand of mean strength for the principal diseases of the Army for admissions and for total losses (deaths and discharges) were as follows, these being the average annual rates:

TABLE IV.

	Admissions per 1,000.	Total losses per 1,000.
Diarrhoea and Dysentery	711	24.77
Typhoid fever*	62	13.54
Respiratory diseases	120	7.40
Rheumatism	114	5.50
Malarial diseases	522	4.04
Venereal diseases	83	1.13

In the light of our present knowledge, however, these figures require some interpretation. In the Report of the Board which investigated the "Origin and Spread of Typhoid Fever in United States Military Camps in the Spanish War of 1898," it is shown that the surgeons correctly diagnosed only about half the cases of typhoid fever, most of those improperly diagnosed appearing as malarial fever. If so wide a margin of error occurred in 1898 with all the means for exact diagnosis now existing, we may well imagine that the error was much greater before the days of blood examinations and when the clinical thermometer was not in use and small degrees of fever could not be accurately observed. Therefore, in many of the milder typhoids the element of fever would be disregarded, or they would, when diarrhoea was a prominent symptom, as it is in the majority of cases, be diagnosed chronic diarrhoea. Or, if the morning fever was slight, it would be overlooked and on account of the evening rise be set down as intermittent fever, especially as it has been shown by Reed, Vaughan, and Shakespeare, that mild typhoid is often in fact intermittent in type. A large proportion of the cases of remittent fever should also be transferred to the credit of typhoid. If the typhoids, typho-malarials and remittent fevers are added together, the death rate for them all is slightly greater than that which is given in the report above mentioned for typhoid fever in the

*Includes typho-malarial and simple continued fevers.

Spanish War, whereas if a considerable proportion of these were really malaria, the death rate should be much less. Thus the typhoid cases should be largely increased at the expense of the malaria and chronic diarrhoeas. We must, therefore, give this disease the same bad prominence which it attained in the Boer War, the Spanish War, and the Franco-Prussian War, as the leading cause of military disability and of death in armies, and dysentery should be awarded the second place. It should be noted that during the Civil War, chronic diarrhoea and dysentery seemed, in many cases, convertible terms, and in the reports of autopsies, the typical ulcers of dysentery were found in many of the cases recorded as chronic diarrhoea.

The medical statistics of the Mexican War would be of special interest as showing the diseases which might be expected to occur in an expeditionary force operating under the great variety of conditions of climate and terrain to be found in the extensive territory of our southern neighbor. A comparative table of losses of United States troops in that war, with those of the French and British in the Crimea, shows that in spite of the terrible losses of the latter from disease, of which further mention is made below, our record was worse (See Appendix). Intestinal diseases were the chief causes of loss, especially the so-called "Mexican diarrhoea." The quaint and vigorous remarks of Surgeon General Lawson on the method of raising troops for that war, and its effect on their sanitary condition, are of permanent interest and application whenever volunteer troops are called into the field, emphasizing as they do, the importance of careful physical examinations, a matter which there is always a tendency to disregard or waive under political pressure in times of popular excitement (Report S. G., Nov. 9, 1846, pp. 4-8). It is regretted that space does not permit of this quotation.

The Civil War seems to mark the beginning of a new epoch in the morbidity of armies, because the two infectious diseases which had before that time been the most formidable agents of destruction to the armies of the world did not appear, and seem to have since then ceased to be among the regular camp followers in war, and are now only occasional visitors, namely typhus and cholera.

To appreciate the appalling destructiveness of these diseases it is only necessary to go back to the Crimean War and read the melancholy descriptions of Scriver, for the French, and Milroy, for the British Army.

In the winter of 1855-56, nearly 20,000 cases of typhus occurred in the French Army before Sevastopol, of which one-half died, including thirty-five medical officers. In addition thereto, 53,000 patients were sent to the hospitals at Constantinople, of which one-third perished, together with a large number of the attendants, from this most contagious of diseases.

Cholera slew both Lord Raglan, the British commander, and the French Marshal, Saint Arnaud, and in the months of July and August, 1855, lost to the French Army before a shot had been fired, as many men as were killed by the enemy during the entire campaign and siege. In addition to these losses there were repeated other outbreaks of both diseases.

The French lost in the Crimea, 69,229 men out of 309,268 sent there, and about 65,000 were invalided home. About 7,500 fell in battle. The British sent 111,313 men, of whom 21,097 died. They had 25,841 cases of typhus and typhoid, with a death rate of twelve per cent and one-fourth of the total mortality from disease was due to cholera.

Typhus followed the march of the armies of Napoleon and of his opponents and was especially prevalent in the campaigns of 1812, 1813, and 1814, and decimated the unhappy survivors of the retreat from Moscow. It was the invariable attendant of the wars of the Eighteenth Century and of the Middle Ages, and in the Thirty Years War, claimed more victims than the sword. It was the characteristic camp disease as shown by its older names, *febris bellica*, *febris castrensis*.

In the last quarter of a century this disease has become rare, and few of the practising physicians in America have seen a case of it. It is to be hoped that under the improved conditions of modern civilization, it may disappear. We have at least ground for the belief that with the great advance that has been made in preventive medicine our armies as well as our cities, may hereafter be kept free of it.

Cholera cannot, unfortunately, be so lightly dismissed as either obsolete or having no terrors for the American soldier.

Asiatic Cholera is spread by the taking into the mouth of the specific organism which proceeds from the intestinal discharges of another patient. In its method of spread it is closely parallel to typhoid fever, being disseminated by the agency of infected water, milk and other food, by infected hands, and drinking utensils. It survives long periods in clothing and bedding. It is carried on the bodies and in the intestines of the common fly, and as was pointed out by Sternberg in 1892, no system of house quarantine can be effective which does not take into account that ubiquitous insect. It is not immediately destroyed by a freezing temperature. From the similarity of their manner of transmission, it is evident that cholera will spread under the same conditions as typhoid, if once introduced, and no army can be considered safe from its ravages if once it should appear in the theatre of operations. The methods of prevention will naturally be the same as for typhoid, with the addition of quarantine against infected places to prevent, if possible, its introduction. This latter precaution cannot be used against typhoid, as, like the poor, we have it always with us.

Yellow fever, plague, and beri-beri are other occasional visitors which are not, however, to be feared by our Army. The first is, as has long been known, easily shaken off by moving commands, and to the two latter we seem relatively immune, though to Asiatics they are still formidable.

Passing then to the common camp diseases we see from the preceding summary of the morbid statistics of recent wars, those which seriously affect the efficiency of armies are:

1. Typhoid fever,
2. The diarrhoeal group, including dysentery,
3. Malaria,
4. The respiratory group,
5. Rheumatism, articular and muscular,
6. Venereal diseases.

Of these the first three and the last must be considered preventable diseases. The occurrence of the respiratory affections

can be, to a considerable extent, diminished but not entirely prevented, by providing proper ventilation. The rheumatic group is, in the present state of our knowledge, to be considered under military conditions as non-preventable, although it is now recognized that acute articular rheumatism is an infectious disease with its port of entry probably through the tonsils.

The measures of precaution can be best discussed after giving briefly the characteristic features of each disease as they appear under the conditions of the soldier's life, a knowledge of the aetiology and climatical features of each being assumed, as it is not possible, within the limits of an article, to give them fully or cover the whole field of military hygiene.

Typhoid fever is today, on account of its wide dissemination, the persistent vitality of the infecting organism, the duration and severity of its attack and its large death rate, the most formidable infectious disease with which we have to contend in military life. With the improved diagnostic methods of recent years the widespread occurrence of mild and atypical forms of this disease is being more and more recognized, and its importance is being correspondingly appreciated. The report of the Typhoid Board in 1898, threw a flood of light on this subject, and remains a permanent monument to the vast labors and scientific acumen of the members of that board—Reed, Vaughan, and Shakespeare. They studied the medical histories, company by company, in 106 regiments, of which the records of ninety-two were sufficiently complete to be available. In these regiments occurred 20,738 cases of presumable typhoid, with 1,580 deaths, a case mortality of 7.61 per cent. In addition to these cases they show that the short attacks of fever of a few days duration only, which were diagnosed malarial, had a distinctly protective influence against typhoid. Thus, out of the 55,829 cases studied with reference to this point, 2.7 per cent of these who had such previous attacks, contracted typhoid, while of those who had no such previous so-called malarial attack, 16.1 developed typhoid. Also to their surprise it was found that previous attacks of diarrhoea and gastro-enteritis, instead of exercising a predisposing influence to typhoid infection, were in a like manner protective, the latter

disease occurring in 6.8 per cent of those with a history of intestinal troubles and in 15.3 per cent of those with no such history. The inference is, of course, that many of these cases of slight fever, diarrhoea and gastro-intestinal catarrh, were in fact mild typhoid. This was subsequently confirmed by one of the board when investigating a camp epidemic in Cuba. He found that many soldiers who had been sick of the milder affections above mentioned, gave on examination of the blood, the characteristic Widal reaction of typhoid. So it is evident that our statistical tables do not properly represent the prevalence of typhoid, the figures of which should be largely increased, and those of malaria and diarrhoeal diseases correspondingly diminished. Naturally such mild cases were not treated as infectious and so must have contributed greatly to the spread of the disease.

Typhoid is spread only by the introduction into the mouth, of the specific bacillus. This organism has remarkable tenacity of life. It has been demonstrated to live and propagate in a suitable soil, eleven months after it was planted; in sealed bouillon cultures it has lived over a year; in clothing for several months; and dried on threads in a dessicator over sulphuric acid, for 203 days. In distilled water it will live for three months, but in non-sterile water or sewage or sea water its life is shortened by competition with the common water bacteria.

It is discharged in vast numbers with the excreta of the sick and frequently persists in the feces for several weeks during convalescence. In almost one-fourth of the cases it is present in the urine often in enormous numbers so that a single drop may contain millions, and this condition may persist for long periods of time. "Because of the frequency with which it is voided its comparative inoffensiveness, its easy dissemination and the relatively great number of organisms present, infected urine is the most dangerous excretion of the typhoid patient" (Vaughan). It is evident, therefore, that every case of typhoid in a camp is a potent source of danger to his comrades and during his illness and convalescence he should be surrounded with the same precautions to prevent infection as would be taken in a case of cholera. If this were systematically and carefully done,

camp epidemics would be far more easily and quickly brought under control, as has been demonstrated by the success which has attended the so-called "stamping out method" of Koch, which is essentially the treatment of typhoid as a highly contagious disease. It is stated that in the Japanese Army it is regarded as a contagious disease and treated by strict isolation.

Unfortunately this will not suffice, for as has been shown by the Typhoid Board, every new regiment brings the infection into its camp of mobilization, and the mild unrecognized cases can be counted on to spread the infection when once introduced. Therefore a systematic disinfection of all excreta must be practiced in all permanent camps, and the surface of the camp site carefully protected from pollution. Not only the gross and evident pollution with fecal matter must be avoided, but also that from kitchen slops, scraps of food, offal, and other wastes which contaminate the soil and make it a favorable medium for the growth of the organisms of typhoid, dysentery and infectious diarrhoeas. The tying of horses about the tents should not be permitted, and the corrals and stables should be well drained and have careful daily police. An additional reason for this lies in the fact that the common fly deposits its eggs chiefly in horse manure and to a neglect of this precaution must be attributed in large measure the myriads of flies which plagued the camps of the Spanish-American and Boer Wars, and visiting with impartial activity the sinks and kitchens proved efficient carriers of contagion. The fouling of camp sites by urine is a dangerous practice and yet one that is very common especially at night. Yet it is one against which it is very difficult to institute effective measures as those in authority do not readily appreciate its importance, on account of the inoffensive character of this secretion. The urine is probably, even when not infected, the waste product which most promptly renders the soil propitious for the growth of the typhoid bacillus. The habit of urinating about the camp at night can only be stopped when urine tubs are provided and placed in the company streets at night. These should contain a disinfectant, and if of wood (wash tubs or half-casks) should be coated inside with tar. The writer has a sad memory of how all

his efforts to have this provision made for a typhoid infected command during the Spanish War were unavailing because the Quartermaster refused to purchase the casks necessary to make the tubs. While it should be impossible for a staff department not charged in sanitary responsibilities to obstruct necessary measures of this kind, the indifference of commanding officers is usually in part responsible.

The disposition of excreta is the most important and often the most difficult problem of camp hygiene.

Many ingenious devices have been at various times brought forward to solve this vexed question but most of them lack portability or are for one reason or another not practicable. For a command which is marching, the trench latrine will always have to be depended upon, and the sanitary officer will have to use his ingenuity and experience to obviate its defects. It is needless to say that the regimental surgeons should be consulted as to the location of the sinks, and where the ground is stony or the ground water near the surface, questions of alignment must not be insisted on but suitable spots selected even if a somewhat longer walk is involved. They should be at ample distance from the kitchens preferably on the other flank of the company. The company cook will be the cleaner, if he works under the captain's eye, and it is better that the officers should suffer occasional discomfort from smoke or boiled cabbage than that the men's food should be infected with typhoid or dysentery. It is advisable, whenever practicable, to burn out the sinks each forenoon with petroleum. This produces a superficial disinfection and destroys the paper which is otherwise apt to be blown about the camps. It also destroys the eggs and larvae of certain flies which may be deposited there. But this burning should not take the place of the careful use of dry earth several times a day. When it rains and there is no dry earth to be had, a disinfectant should be used. Of course sinks should always be ditched like tents to prevent flooding. When transportation will permit, each company should have a fly tent or old wall tent to cover its sink.

It is stated above that the trench latrine is to be relied on for marching commands. Its use should, however, *be restricted*

to temporary camps and emergency use. This may be done safely, as moving commands are healthy and do not, as a rule, suffer from typhoid or dysentery. If the command remains longer than two days in one camp, lumber should be obtained, if practicable, and each sink progressively improved so as to comply as far as possible with the following requirements:

1. It should be covered either with a tent or other roof, and should of course be ditched, to prevent its being filled with rain.

2. In order to exclude flies the trench should be boxed in and holes constructed with hinge covers. The hinge may be made of leather or canvas.

3. A bar running along above the seat should prevent the covers being raised quite to a right angle. This makes them self-closing and prevents squatting on the seats.

4. A urinal should be provided at one end or outside. This should be either a tub or a tarred trough leading to the trench.

5. Behind the seats should be a sloping lid which can be raised to permit of the use of dry powdered earth or lime.

If the latter is used it should be fresh, unslaked and preferably in lumps which should be broken up before use. Finely powdered lime becomes air slaked and inert in a few days.

If the trench becomes flooded it should be disinfected by a liberal use of unslaked lime, chloride of lime, carbolic acid, or bichloride of mercury, in order that an overflow may not carry infection broadcast. If troops are to be kept in one camp longer than two weeks it should be regarded as a permanent camp and the trench latrines filled up and abolished. They should be replaced by the sanitary trough sink devised by the board above mentioned and adopted for use in the Army by G. O. 170, A. G. O. 1899. These sinks are very ingeniously constructed and can be readily taken apart for transportation. Each sink suffices for 100 men while the excavating apparatus will do service for two or three regiments. This apparatus works admirably under all conditions except where the soil is so sandy or so soft that the excavator cannot be pulled when full. Under such cir-

cumstances it may be necessary to corduroy a short road to the place of discharge. This system has always given perfect satisfaction whenever tried, and is believed to be the best yet devised, when sewers cannot be provided. The use of toilet-paper is necessary with this apparatus as the excavator refuses to take up Sunday editions of the metropolitan journals. This, however, is not a disadvantage, as toilet-paper should be supplied to all soldiers in the field. The reason for this is apparent to any one who has had occasion to see soldiers in the field stripped for examination. The drawers of most of them will be found to be soiled with fecal matter and this is especially the case with patients admitted to hospital with typhoid fever and diarrhoea—the very cases in which such a condition is most dangerous. The reason for this lack of cleanliness is because soldiers are not supplied with a proper detergent paper and the result is a dangerous soiling of the hands and clothing, which is undoubtedly an important factor in the spread of typhoid by contact, in ways which will be presently described.

Kitchen garbage and slops should never be thrown upon the ground. Such parts of it as can be burned should go into the kitchen fire, while the wet portion should, in temporary camps, be buried, and in permanent camps placed in a slop can and carried away by a sanitary garbage cart of the pattern in use by the Quartermaster's Department. One of these can easily do service for a brigade. Its ultimate disposition should be in a crematory, of which many forms have been devised. The stable sweepings should also be thus disposed of unless there is a commercial demand for them.

The ideal method of disposing of all camp wastes would be by incineration and a number of different patterns of crematory latrines have been invented in which excreta could be destroyed by combustion in situ and without the necessity of handling or removal. These have, however, in practice been found either not transportable or offensive from the products of combustion, or both, and a perfectly successful device has not yet been found. Prior to 1898 the attention of sanitarians and the medical profession generally was directed almost exclusively to infection

through water and food as the method of transvection of typhoid fever, and it was believed and taught that if soldiers would boil their drinking water they would be healthy. But it was found, to our surprise, that the disease spread in camps like that of Jacksonville, with an artesian water supply which was above suspicion, with the same certainty as in those where the purity of the water supply was open to doubt, and one of the most interesting and valuable facts brought out by the Typhoid Board, was that water pollution played a subordinate role, and that the disease occurred in a series of company epidemics, being spread as a contagious disease from man to man. To those familiar with the close contacts of camp life, and the difficulties in the way of personal cleanliness, it will be evident that contact transmission can occur in many ways. The hands of patients, especially those with mild cases, would readily become soiled with the infected discharges and would transfer such infection to certain parts of the tent which are often touched by the hands, and to the utensils used in common. The front vertical pole of a wall tent, and the flap of a conical wall tent are often touched by the hand of each soldier entering it. These places will, therefore, soon become infected and will pass it on to others. Such a local culture will soon die out in bright sunny weather but it will be often renewed. Cultures will also be brought from the latrines or other localities polluted with the urine and feces of mild or convalescent cases, on the shoes, and distributed on the tent floors. The clothing and blankets will also soon acquire it from the sources above mentioned. The bacillus may also be passed around on books, playing cards and other articles of common use. But, although these contact methods of acquiring typhoid have assumed enlarged importance, the necessity of guarding against infection from water, milk, and other articles of food must not be minimized. Fly infections must be prevented by protecting the food and also the latrines from flies, and by diminishing their number by an efficient camp police. Cockroaches will also convey the typhoid bacillus to food (Hare).

The sterilization of water is the most difficult and the most important of the precautions relating to food, and it is necessary,

not only as a protection against typhoid, but also against dysentery and the specific diarrhoeas. The bacteria-proof filters, such as the Pasteur and the Berkefeld, are not adapted to camp use on account of their fragility. Sterilization by other means is, therefore, necessary, and of these boiling is the reliable and the most universally practicable. If this has to be done in the ordinary way, it requires much fuel and much time, especially as the water must be again cooled. The Forbes sterilizer, which is now furnished by the Quartermaster's Department, obviates this by the ingenious device of making the water, after boiling, give up its heat to the inflowing current, so that the sterilized water is discharged only about five degrees Fahrenheit warmer than when it enters the apparatus. The whole volume of water at seventy-two degrees Fahrenheit has thus to be raised practically five degrees Fahrenheit instead of 160 degrees Fahrenheit, and the immense economy in fuel and time is apparent. This apparatus required petroleum for fuel. Its value has been thoroughly tested in the Philippine service, and to it, in large measure, we owe the immunity of our troops from serious loss while the native population were perishing around them by thousands, in the great cholera epidemic of 1902-3. By a recent improvement the inventor has made it impossible to force over unboiled water by increase of pressure, as was sometimes formerly done by careless and ignorant attendants who desired to increase the output.

A German apparatus has been used with satisfaction by their African Colonial troops. It is conveniently carried on wheels and aerates and filters the water in addition to sterilizing it. Either wood, coal, or petroleum can be used as fuel. The output is 500 liters an hour (Henneburg's Army Drink-water Apparatus).

The chemical disinfection of water has lately received much attention on account of its ready applicability to military uses, but the results have unfortunately been, as yet, unsatisfactory.

Water carts are used in the armies of other nations and their introduction into that of the United States should be seriously considered.

The introduction of typhoid by food supplies, such as milk, ice, and oysters, can be prevented only by the vigilance of the

regimental medical officers supported by the sanitary inspector of the Division. The precautions to be taken differ in no way from those in civil life.

An important measure of camp hygiene, and one always practicable, is the regular moving of the rows of company tents so as to permit the sun to disinfect the soil surface covered by them. If each row of tents is shifted the depth of a tent toward the next company on either side, the arrangement of the camp remains undisturbed while the sites formerly covered are exposed. This should be done weekly and at the end of that period they could be shifted back to the old site. This does not, however, obviate the necessity of moving the camp where evidences of soil pollution become apparent. One of the most serious errors of the Spanish War was the continuous occupation for months of the same camp sites, and the disregard of recommendations of medical officers that they be moved. The conveniences which had been created—tent floors, piped water, shower baths, mess houses, store houses, etc., at heavy expense to the Quartermaster's Department, naturally made such moves unpopular with commanders and supply officers.

Sunshine is, fortunately, one of the most efficient destructive agents for the typhoid organism, destroying it in one and a half to two hours, and most other pathogenic organisms are equally susceptible to it. Diffuse daylight, though much less potent, is also a valuable agency. The value of both is enhanced by desiccation, but of course their penetrative power in clothing and other opaque material is limited. They are of great value, however, in camp life, and soldiers should be required on all bright days to loop up the walls of their tents and suspend their blankets or clothing in the sun. When a command is infected with typhoid, however, a systematic disinfection of bedding and clothing by steam or disinfectant solution becomes necessary in addition to change of camp and the segregation of all cases, in order to shake off the disease.

With regard to the freedom from typhoid fever and dysentery, of the Japanese Army in Manchuria, it is of the utmost interest and importance to determine, as far as is possible with

the very meagre data available, what are the reasons therefor.

Is it, as is generally believed, due (1), to a strict observance on the part of the entire Japanese Army of the sanitary regulations prescribed by their admittedly excellent medical staff; or (2) have the Japanese a constitutional and racial relative immunity to these diseases; or (3) does their simple and chiefly vegetable diet produce intestinal conditions unsuited for the development of the *B. typhosus* and *B. dysenteriae*, or a bacterial flora with which these organisms cannot successfully compete? As against the first, we have the testimony of the observers who have been authorized to accompany the armies and who thus have had the best opportunities for observation, that the Japanese soldier on the march is quite as regardless of camp police, or of safe-guarding his water supply as is the American volunteer. It appears that the delay in providing sinks was such that where there was a halt of several days duration, walking with comfort became difficult on account of the wide-spread contamination of the camps with excreta, while offal was strewed about and sources of water supply were used for bathing in a way which was a shock to European ideas. On the other hand there is evidence that in the rear of the army and in camps of permanence, careful attention was paid to camp police, and the usual sanitary precautions were taken. There is reason to believe that the Japanese, in common with other Asiatic races, are less liable to typhoid than are Western races. An examination of the last obtainable Japanese census (1896), shows that the death rate from this cause was .213 per thousand of population, while that in the United States was, by the census of 1900, .416 per thousand. As the case mortality is much higher in Japan, it is probable however, that a considerable proportion of the milder cases, especially among the children, are not correctly diagnosed. Recent investigations in India by means of the serum agglutination and sedimentation reaction test, show that while that race is much less susceptible than are Europeans living under the same conditions, still the disease is much more common among native children than has been supposed. When the conditions of peasant life in Japan, and the large use of human excreta for fertilizing

purposes, with the repeated handling and spreading of it over the soil, are considered, it is highly probable that a vast majority of the individuals who are not naturally immune, become so by an attack before reaching the military age, and so Japanese armies come into the field in a condition of relative immunity.

It is probable that the European armies of a century ago and preceding times, enjoyed a like protection, because the general ignorance of sanitary matters and the failure to safe-guard sources of water supply must have resulted in a routine infection of the juvenile population with consequent protection in adult life. Of course the occurrence of second attacks is recognized, but the protective influence of a first attack is very great.

Thus in military life, the soldier of today pays this penalty of susceptibility for the protective influences with which modern civilization has surrounded him in his home life.

The relation of a vegetable dietary to typhoid susceptibility is a question as yet of conjecture rather than demonstration. It is said, however, that among the native troops of the British Indian Army, the Ghurkas, who are meat-eating and alcohol-drinking, show a much higher susceptibility to this disease than other native regiments.

It must be observed, however, that this theory of relative immunity will not explain the small morbidity of the armies of Kuroki and Oku from dysentery, a disease from which both the civil population and other Japanese armies have at times suffered severely. It has, however, been pointed out above, that marching armies are not as a rule sufferers from these diseases, but only those which have remained long on polluted camp sites. When, also, the national Japanese habit of taking their water boiled in the shape of tea, and the fact that the Manchurian wells are, as a rule, deep and of excellent quality are considered, their good record may be explained on the supposition that sanitary precautions were seriously and carefully carried out in their fixed camps, where such precautions are practicable, even though they were, as we know to be a fact, neglected by marching troops, where elaborate sanitary measures are impossible of execution. For the beautiful dream of a Truly Sanitary Army, in

which the bacteriologist marches on the skirmish line, and the exhausted soldier waits by the well-curb for laboratory reports before quenching his thirst, is impossible from the scientific as well as the military point of view. Fortunately it does not seem in practice to be necessary.

DIARRHOEA AND DYSENTERY.

The following from the Medical History of the Rebellion shows the importance of this group in the Civil War:

"These disorders occurred with more frequency and produced more sickness and mortality than any other form of disease. They made their appearance at the very beginning of the war, not infrequently prevailing in new regiments before their organization was complete, and although as a rule comparatively mild at first, were not long in acquiring a formidable character. Soon no army could move without leaving behind it a host of the victims. They crowded the ambulance trains, the railroad cars, the steamboats. In the general hospitals they were often more numerous than the sick from all other diseases, and rivalled the wounded in multitude."

They caused 57,265 deaths in the Federal armies out of a total of 157,004 deaths from disease and over 18,000 discharges. From these numbers must be deducted as above printed, a large but indeterminate number of typhoid cases, but there still remains an imposing number which, while the result of several distinct infection agents, permits of a grouping under one head not only on account of clinical similarity, but because of the fortunate identity of the preventive measures which are required. By far the most important morbid agent of this group is the bacillus dysenteriae of Shiga, which is the cause of the epidemic dysentery of armies, especially in temperate climates. This bacillary dysentery is stated by Caldwell to have been the only type seen in the Boer War. From its invariable appearance in that war among troops occupying, even for a short time, foul camp sites, that author is induced to believe that the peccant organism was one which although primarily not pathogenic or capable of causing only simple diarrhoeas, under such favorable conditions develops a progressive infectiousness and malignancy. This is a

somewhat favorite theory with military surgeons, and is convenient as accounting for outbreaks which it is otherwise difficult to trace.

Before the publication of the report of the Typhoid Fever Board, it was often invoked to account for camp epidemics of that disease. But such an autochthonous origin is not necessary in the light of recent investigations of Flexner and others, which show that this organism (*B. dysenteriae*) is probably as ubiquitous as that of typhoid fever, and is a common cause of the severer diarrhoeas of civil life and of the very fatal summer diarrhoeas of children. In its power of independent saprophytic existence in water and in soils in which nitrates are present, it probably rivals *B. typhosus*. Caldwell notes its proclivity to attack those suffering from disordered conditions of the intestinal tract, and this was also noted by observers in the Civil War. In this respect it differs from typhoid fever, according to the observations of the Reed Board above noted.

Amoebic dysentery is less common in temperate climates than the bacillary, and is much less contagious; its chief mode of spread being by water and infected fresh vegetables and fruit. Where water sterilization, with culinary cleanliness, is practiced, it is not a source of danger.

Catarrhal diarrhoeas are, as has been seen, a feature of the initiatory period of military service, and are due to the abrupt change of diet and to improper preparation of the food. While they become less frequent as the soldier becomes seasoned to camp life, and as the company cook acquires skill, they are of importance as increasing the susceptibility of the soldier to Shiga infection. Another form of simple diarrhoea is caused by chill of the abdominal organs when hot days are followed by cool nights. It is in this complaint that the abdominal band is of real value. This at least is the personal experience of the writer. That much abused contrivance acquired its unpopularity among American soldiers because it was worn in the daytime or when the nights were not cool, greatly to the discomfort of the wearer, and it was also found to have no protective influence against the intestinal infections.

MALARIA.

Our knowledge of the life cycle of the causative agent of malaria is probably the most brilliant and valuable medical discovery of the last quarter of a century, although popular recognition and application of this knowledge has been singularly slow. It is now comparatively easy for any one in civil life, by a careful and methodical use of screens and mosquito nets, to avoid malarial infection, if, as is usually the case, the conditions of his life as to night exposure are under his own control. Unfortunately, however, the soldier has no such personal control. He must do his tour of guard even if anopheles are waiting to bite him, and follow his command into regions no matter how insalubrious. His list of necessities is also unduly long when measured by his capacity to carry them, while transport officers protest against any further loading of the regimental wagons. And yet, when the great prevalence of this disease in all our wars is considered, the imperative necessity of taking all possible precautions against it is evident. Fortunately these are not such as will unduly burden the soldier or the wagon train. Medical authorities are now agreed that malaria is carried only by mosquitoes, and these only of one species. This species is not migratory, or inclined to travel great distances, and rarely bites except at night. If, therefore, soldiers when campaigning in regions known to be malarious, are provided with a head net or a square of good mosquito net weighing only three or four ounces, they can, to a very great extent, protect themselves. Head-nets that can be worn with the campaign hat should be provided for the guard as was done for the troops which occupied Cuba after the Spanish War. As the native population is the source of infection for the mosquitoes, the neighborhood of villages and farm houses in malarious districts should be avoided as far as possible in selecting camp sites. In camps of permanence, sanitary officers will of course attack the breeding places of mosquitoes with petroleum, or by drainage, and patients suffering from the disease should be carefully protected with nets to prevent its spread. Mosquito nets of excellent quality, with suitable frames, are furnished to all field and camp hospitals for this purpose. The prophylactic adminis-

tration of quinine is also a valuable resource, and should always be resorted to when a command is seriously exposed, and nets are not provided. The method of Koch, which is based on a study of the life cycle of malarial parasite, should be used. By this, quinine is given two days in each week—a gram the first day, half a gram the second, and then none for five days, when it is again given in the same way. The use on the exposed skin of the essential oils and petroleum, or a mixture of the latter with vaseline or grease, also affords a certain amount of protection.

VENEREAL DISEASES.

These diseases, as shown in Table I, contribute greatly, and in the English-speaking armies enormously, to the constant non-effective rate. They are more prevalent in peace, however, than in war, and in troops having foreign stations, especially in the tropics, than at home.

A rate of prevalence as high as that in our Army, and especially in that of Great Britain, is a very serious factor in reducing military efficiency, for such men usually promptly break down under the strain of active service and by the development of suppurative adenitis and other complications become unfitted for duty for long periods.

The vast difference between the European armies and those of the English race is due to the fact that in the former, similar precautions are taken to prevent the spread of venereal affections as with other contagious diseases. To the latter nations, however, it has seemed best not to recognize what is offensive to their moral sense, even though the social fabric is undermined, and these diseases are spread, not only among the incontinent, but wreck the health of pure women and innocent children. This is permitted in order that the law may not, by recognizing the existence of the prostitute, seem to extend a quasi-legitimacy to her trade. It is also claimed that the registration of prostitutes does not effectually accomplish its aim of reducing venereal disease. Without discussing this question with respect to the civil population, there can be no question of its efficacy with respect to garrisons and armies, and especially where the inspection of

the women is combined with weekly or other regular examinations of the troops for the purpose of detecting venereal disease. These latter inspections have the additional value of making it possible to penalize those who fail to report themselves for treatment or who expose themselves to repeated infections.

These inspections of troops were put in practice in a number of the garrisons of Cuba during the military occupancy of the Island without exciting any strong opposition, and it is believed that they could be introduced throughout the Army, without exciting popular clamor, and with great benefit to its health. In time of war, when cities are occupied and venereal diseases become prevalent, the registration and inspection of prostitutes can be added as a measure of military necessity and without exciting criticism, as was done with such signal success at Nashville, by General Granger, in August, 1863, and following this example about a year later, at Memphis, Tennessee, by the military authority in conjunction with the civil government of the city.

In time of peace every possible means should be taken to keep the soldier away from the places where he contracts these diseases, by providing him reasonable and attractive amusement and recreation in the evenings. To this end the restoration of the canteen, with the regulated sale of beer and refreshments, is desirable, with all its recreation features developed, such as libraries and reading rooms, card and billiard rooms, gymnasium, bowling-alleys and swimming pool. No money could be better invested or would give greater return in efficiency of the troops. The increase of venereal diseases and alcoholism since the abolition of the canteen is too well known to need the use of figures here for proof. The two diseases go together; the low saloons which have sprung up in the vicinity of all posts, always have the brothel features at hand or close by, and after the soldier has been made drunk he falls an easy victim to the prostitute.

The measures which have been recommended for the control of venereal disease will at the same time diminish alcoholism. Both are children of idleness and ennui, and are more prevalent

in the dull round of garrison duties than amid the strenuous and exciting conditions of war.

In the list of most important diseases of the United States Army, in the Civil War (Appendix), it will be seen that venereal diseases stand fifth as regards number of admissions and seventh as regards total losses.

Vaccination being performed as a routine measure upon enlistment, mumps and measles are the only eruptive fevers which are of importance in our Army. These always assert themselves in camps of mobilization, and the latter, from its tendency to leave pulmonary sequelae, is a cause of losses as well as admissions. This is shown in Table VI (Appendix), for the Civil War. Measles and mumps patients are usually treated in separate detached camps at some distance from hospital limits, and those from volunteer regiments miss greatly the companionship of their comrades and are much inclined, unless very closely guarded, to slip off and pay surreptitious visits to their regiments, with results that are evident after the usual period of incubation. It is, therefore, advisable to have the hospitals for these diseases as distant as is compatible with administrative convenience, from the troops and to deprive all patients of their clothing, putting them in pajamas and long woolen dressing gowns, which, though comfortable in hospital, are not adapted to visiting.

The uniform and equipment of the Army are satisfactory, and have no defects which injuriously affect the health of the soldier.

As regards his food, there is no respect in which civilized man is so conservative and so opposed to radical changes as in the matter of diet. Nor is this conservatism altogether to be deplored, for dietary habits which are the result of custom and environment through generations, cannot safely be made the subject of hasty generalizations or rash experiments. There is one innovation which the writer has preached for years with partial and local success, namely, a greater use of soups and sauces in soldiers' diet. A great improvement was made some years ago in the fare of the British soldier, simply by the introduction of the

stock-pot, and a like advance always marks its introduction into a company or hospital mess in our Army. It is the best remedy for the monotony, which is the chief fault of our ration as issued. In the field the boiling of meat and vegetables together affords a nutritious and appetizing soup, and is the only way in which lean, tough meat can be cooked so as to make it good and digestible. Although there seems little in the Japanese commissariat which can be adopted for the American Army, the Russian soup-cart is certainly worthy of imitation.

ADMINISTRATION AGENCIES.

It has been already stated that however excellent are the sanitary regulations, and however wisely adapted by experience to meet the special limitations and needs of military life, they will not make an army healthy unless there is a proper adjustment and co-ordination among the different agencies involved in carrying them out. These are:

1. The Medical Department, which is the originating, guiding and informing agency, which has the duty of caring for the sick, and preventing disease.

2. The line officers beginning with the commanding officer, who must order and enforce the execution of general hygienic measures, and the regimental and company officers, who must understandingly execute general measures, and in addition must educate their men in matters of personal hygiene.

3. The soldier, who must be taught the simple rules of personal hygiene and must put them into practice.

4. The staff department which is charged with the duty of providing the sanitary apparatus and supplies and the trained personnel for running them.

1. The Medical Department must be brought to the highest state of efficiency by being given adequate numbers for its work and adequate inducements to attract first rate men. The President in a special message to Congress on January 9, 1905, said: "I am satisfied that the Medical Corps is much too small for the needs of the present Army, and therefore very much too small for its suc-

cessful expansion in time of war to meet the needs of an enlarged Army and in addition to furnish the volunteer service a certain number of officers trained in medical administration. * * * If the Medical Department is left as it is, no amount of wisdom or efficiency in its administration would prevent a complete breakdown in the event of a serious war."

To the present organization for field service, must be added a Medical Inspector for each corps and division. The new division numbers close to 20,000 men and its chief surgeon will be so overwhelmed with questions of supply and administration, and those relating to the numerous medical personnel, that he will not have the time to act as Medical Inspector. To do all the work laid down for Medical Inspectors by Par. 645, Field Service Regulations of 1905, will take the entire time of an active capable man, and will require many hours out of his office on horseback and on his feet. The Division Medical Inspector should have as his assistant a competent bacteriologist, who can make blood examinations, water analyses, etc.

2. The education in sanitary matters of line officers is the flywheel of the machine. Until it can be put in motion no sanitary system will be effective. The whole question of the necessity for their training and the means of obtaining it has been discussed in a very thorough and admirable manner by Captain Peter E. Traub, 13th Cavalry, in the Seaman Prize Essay of the Military Service Institution for 1904. As shown therein, the enforced study of military hygiene is necessary at the military and naval academies, and the post and service schools, and its practice should be made an important feature in all maneuvers. The medical officers will give this instruction to officers. In the Japanese Army, sanitary instruction is a part of the regular course at the military schools and enlisted men are instructed also, both by company and medical officers.

3. For the instruction of the individual soldier in the elements of personal hygiene, his company officers must be relied on. This must be done by precept and example, by formal lectures and informal personal advice and instruction, and enforced by military

discipline when necessary. Every soldier should be required to learn perfectly and understandingly the rules of personal hygiene given in the Soldier's Hand Book.

4. For the prevention of disease in fixed camps we have seen that a considerable equipment of sanitary apparatus is necessary. To insure the purity of the water, sterilizers and water carts are required. For the disposal of wastes, the trough and excavator system, or some system of incineration; also urine tubs and disinfectants and garbage cans. These, and especially the water sterilizing apparatus, will require capable and responsible non-commissioned officers in charge, and for the excreta disposal, hired scavengers under intelligent supervision. What department shall be charged with this service? Shall it be the Quartermaster's Department,—that overloaded Atlas which already staggers under a world of heterogeneous and crushing responsibilities,—transport, construction, clothing, equipment, supplies, and all the odd jobs of the army? Or shall the administration of sanitary affairs be given to the sanitary experts of the army, and placed under the Medical Department? The duty of scavenger to the Army is not an attractive one, and the Quartermaster's Department will probably give it up with a pleasure commensurate with the reluctance with which the Medical Department will assume it. But the latter has at hand the trained non-commissioned officers and intelligent personnel which could supervise the work and be placed over the hired civilians who would perform the manual labor of the camp service. There is besides less chance for friction if everything is in the hands of one department, than if it is divided between two. In each regiment a medical officer should be detailed as sanitary officer. He should select the location of the sinks and supervise their construction. He would also look up the water supply on making camp and see to the posting of the water guard, which should be one of the regular guard details. The sterilization of water and its distribution would be under him. When regiments are brigaded and the regimental hospital becomes a dispensary merely, the Hospital Corps detachment is more than sufficient for its service and a sergeant and two or three men can be readily spared to consti-

tute the sanitary squad. To these may be added such hired laborers as may be needed, who, though employed by the Quartermaster's Department, would be under the sanitary officer. As medical officers are never too abundant, it would be well for large regiments of 1,200 men to be assigned a fourth medical officer, especially for this work. The brigade surgeon would supervise the sanitary service of the brigade, and would have an assistant to be in charge of the sanitary squad at headquarters, and see to the details of the brigade service. For the Division, the medical inspector would be at the head of the sanitary service, and connected with his office would be the field laboratory, where blood tests, examinations of water, etc. for the division would be made.

CONCLUSIONS.

The tendency of modern civilization being to shield men from the infectious diseases in early life, they are now more susceptible to them than formerly, when collected into armies.

The two infections most to be feared in our Army in time of war are typhoid fever and bacillary dysentery.

These always appear but are not formidable to moving commands unless these occupy foul camp sites or drink infected water. In fixed camps they are always to be dreaded and the following precautions must be taken: The water supply, if not above suspicion, must be sterilized. The excreta must be destroyed or sterilized at once by the use of the Reed trough and excavator, or some form of incineratory. Urine tubs must be placed in the company streets at night, and fouling of the camp site by this secretion prevented.

The pollution of the camp in other ways must be prevented. Tents must be moved every week. Kitchens should be on the opposite flank of the company from the sinks. No camp should be occupied more than a month if possible to move it.

Volunteer troops, when mustered in, should be given a careful physical examination.

In order to carry out sanitary rules for the prevention of

disease in the Army we must have the following machinery:

1. An adequate and well-trained medical personnel.
2. A system of instruction in hygiene for line officers.
3. Instruction of enlisted men by their officers in the elements of personal hygiene.
4. The establishment in the Army of a service of camp sanitation to be administered, preferably by the Medical Department. A division sanitary inspector to be at the head of this service.

APPENDIX.

TABLE V.

TABLE SHOWING COMPARATIVE LOSSES OF FRENCH AND BRITISH IN THE CRIMEAN WAR, AND OF THE UNITED STATES TROOPS IN THE MEXICAN WAR. ASSISTANT SURGEON R. H. COOLIDGE, U.S.A.—VITAL STATISTICS OF WAR, 1858.

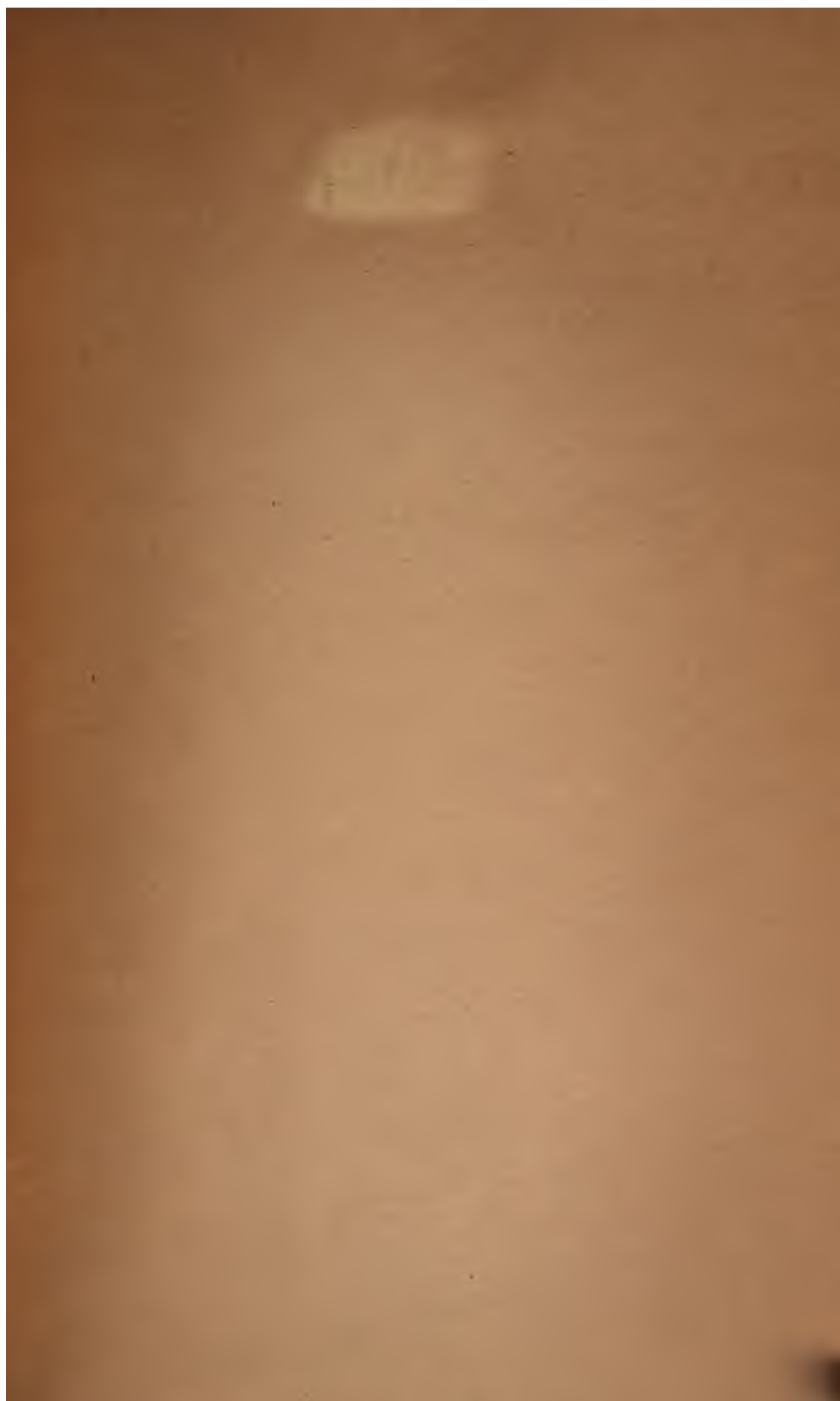
Army.	Aggregate force.	Months in service	Total died.	Loss p. ct.		Total invalided.	Loss p. ct.		Total loss.	Loss p. ct.	
				Total.	Annual.		Total.	Annual.		Total.	Annual.
French	309,268	25	62,492	20.20	9.72	65,069	21.04	10.08	127,561	41.24	19.80
British	111,313	25	21,097	18.95	9.12	16,308	14.65	6.96	37,405	33.60	16.08
United States											
Regulars	15,736	26	3,554	22.58	10.44	2,155	13.69	6.24	5,709	36.27	16.68
Additional force	11,186	15	2,264	20.23	16.20	881	7.87	6.24	3,145	28.10	22.44
Volunt'rs and and Volun- teer Staff	73,532	10	7,087	9.62	11.54	9,216	12.53	15.08	16,294	22.15	26.57
Total U.S. Army	100,464		12,896	12.83		12,262	12.19		25,148	25.02	

The losses in battle were:

War.	Army.	Months in Service.	Percentage of loss in Battle.
Crimean	French.....	25	2.43
"	British.....	25	4.87
Mexican	United States, Regulars.....	26	5.08
"	United States Additional Forces.....	15	1.27
"	United States Volunteers....	10	.88

TABLE VI.
SPECIAL DISEASES, RATIOS PER 1,000 MEAN STRENGTH, U. S. ARMY,
CIVIL WAR, 1861-1865.

		Year end- ing June 30, 1862.	Year end- ing June 30, 1863.	Year end- ing June 30, 1864.	Year end- ing June 30, 1865.
Typhoid Fever,	{ Admission	120.75	90.36	35.25	39.87
	{ Discharge and Death.	21.67	19.78	9.19	12.76
Malaria,	{ Admission,	404.04	460.14	584.09	558.44
	{ Discharge and Death.	3.31	4.70	3.65	4.01
Diarrhoea and Dysentery,	{ Admission	769.79	849.51	638.56	686.00
	{ Discharge and Death.	7.83	31.74	23.62	28.48
Measles,	{ Admission,	77.58	28.59	28.07	17.07
	{ Discharge and Death.	2.32	2.19	2.07	1.91
Venereal Diseases	{ Admission,	85.16	66.65	92.14	80.29
	{ Discharge and Death.	1.85	1.64	.72	.61
Rheumatism,	{ Admission,	159.93	151.89	83.84	97.58
	{ Discharge and Death.	13.01	8.95	2.53	2.04
Bronchitis,	{ Admission,	107.57	114.67	74.59	73.24
	{ Discharge and Death.	3.37	3.63	1.31	1.35
Inflammation of the Lungs,	{ Admission,	39.57	34.32	25.98	20.25
	{ Discharge and Death.	8.61	8.77	6.71	6.37
Total of above Diseases,	{ Admission,	1764.38	1796.12	1562.53	1572.75
	{ Discharge and Death.	61.98	81.39	49.80	57.53
Total for all Diseases,	{ Admission,	2982.81	2696.33	2209.78	2273.11
	{ Discharge and Death.	146.53	208.89	96.80	100.00



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